

VENTURI

Flow Measurement System

INSTALLATION and OPERATING INSTRUCTIONS

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Refer to Barco Venturi Flow Measurement Catalog 866B for Dimensional Information, Media Conversion Factors and General Application Descriptions.



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I. Installation of Barco Venturi

The Barco venturi is to be installed with at least five pipe diameters upstream and two pipe diameters downstream as shown in Figure 1. Pipe schedule shall be same schedule as venturi. 1/2-inch through 10-inch pipe is schedule 40 and 12-inch and above standard schedule (i.e., .375-inch wall).

The pressure tap nipple, valve and quick connect couplings are color coded and supplied with the venturi as separate items. Install the red colored assembly into the upstream pressure tap (painted red). The green assembly is installed in the throat tap (painted green).

In general, the length of upstream pipe will affect the accuracy of the venturi reading. The longer and straighter the lead in section, the more accurate the system. In most cases, five diameters of upstream pipe is all that is required.

When designing a venturi system please consider the following:

1. Install balancing cock or other control valve downstream of the venturi. If this valve must be placed upstream, increase the number of upstream diameters to ten minimum. If valve is severely throttled, it is highly recommended that it be placed downstream of the venturi. If limited space requires shorter upstream pipe length, contact factory.
2. For system requiring high accuracy ($\pm 1/2\%$) contact factory for recommended system configuration.
3. The venturi may be installed in any position: vertical, horizontal, or at an angle. Flow must be in the direction indicated by the flow arrow located on the venturi, Figure 1. The inlet side of the venturi is the end closest to the red pressure tap.

4. For horizontal installation of the venturi, pressure taps should be located at the side of the venturi to prevent clogging and/or air entrapment.

5. The (ΔP) differential pressure reading is independent of high or low liquid system pressures or barometric pressures. If temperature correction is required, use chart in Catalog 866B. Gaseous flow is affected by pressure and temperature variation. For gas flow please consult Catalog 866B or consult the factory.

6. On occasion, dirt, pipe scale or other contaminants may clog the venturi taps. This can be checked by bleeding the pressure tap lines. If flow exists, the line is clear. If no fluid flow occurs, the following steps should be taken.

a) Venturi

—Shut off system and bleed venturi to ensure there is no residual system pressure.

—Remove the nipple, valve, and quick connect coupler from the venturi.

—Using a small wire, or by backflushing, clean the tapped venturi port.

—Check valve, nipple and quick connect couplers for free flow.

b) Meter

—Using an outside source of water, connect nipple, valve and quick connect coupler to the meter. Bleed with the outside water source. If clogged remove valve, quick connect coupler and hose, and clean. Recheck after assembly.

7. Fluctuating readings (meter needle fluctuating over several points) can be caused by erratic

or disturbed flow patterns. Refer to paragraphs 1, 2 and 3. Correct as necessary. In most instances, these fluctuations can be dampened by partially closing the valve near the venturi. Caution must be taken not to completely close these valves.

8. Cold weather operation.

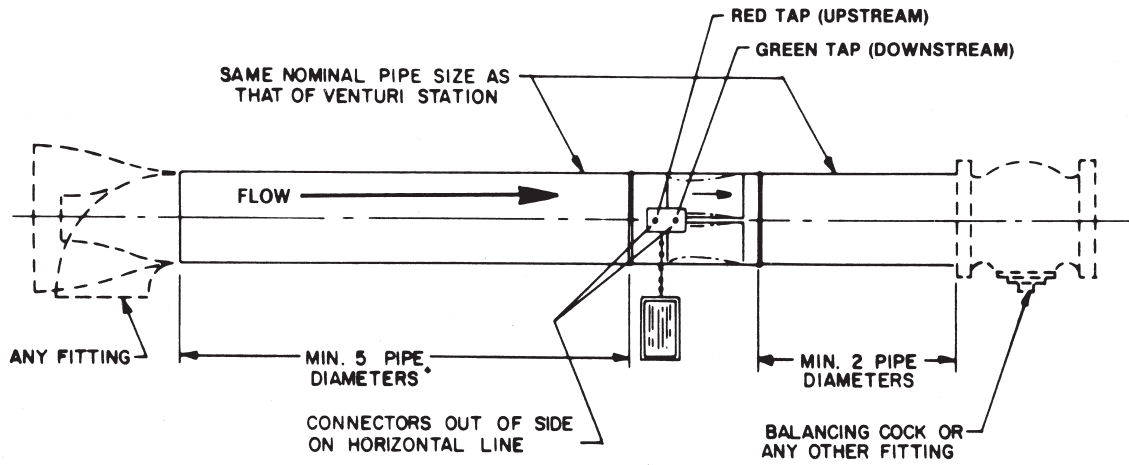
CAUTION

Cold Weather

OPERATING Instructions

- a) Open blowdown valves on meter.
- b) Invert and elevate meter a few feet, if possible, so that ends of hoses are suspended below meter case.
- c) Insert plug in end of each hose to open socket valves and let each hose drain completely.

9. **WARNING:** Do not run water over +212°F. through standard meter. Purge with cold water.



* CONSULT FACTORY FOR RECOMMENDATIONS WHEN SPACE IS LIMITED

Figure 1. Barco venturi installation.

II. Barco Portable Meter

The Barco portable master meter is composed of a 6-inch dial differential pressure gauge, two bleed vent valves, 10-foot lead hoses and two quick connect couplers, housed in a carrying case. The two quick connect coupler are color coded, red for inlet and green for throat.

The following procedure is to be used to make flow measurement reading. Refer to Figure 2.

1. Close all valves, items 1, 7 and 8.
2. Connect red quick connect coupler item 4 to red inlet male connector item 6 and the green quick connect coupler item 3 to the green male connector, item 5. Make sure couplers are properly connected.
- *3. Purge air from inlet side of venturi hose and meter by:
 - a) Open inlet venturi valve item 8 and red inlet vent valve item 1.
 - b) Vent until air-free water flows from the plastic vent tubing item 9.
 - c) Close red inlet vent valve item 1.
- *4. Purge air from throat of venturi, hose and meter by:
 - a) Open throat valve item 7 and green throat vent valve item 1.
 - b) Vent until air-free water flows from the plastic vent tubing item 9.
 - c) Close green throat vent valve item 1.
5. Take flow reading: If reading is a ΔP meter (reads in inches H_2O) go to step 6. If reading is GPM meter go to step 7.
6. Refer to either flow curve attached to venturi, Section VII of this manual or Catalog 866A. Using the ΔP reading, determine GPM for the corresponding venturi.
7. Where balancing is required, adjust balancing cock so that the proper reading (ΔP or GPM) is indicated on the meter.
8. Disconnect portable meter from venturi:
 - a) Close venturi valves items 7 and 8.
 - b) Open vent valves item 1.
 - c) Disconnect quick connect couplers items 3 and 4.
- d) If meter is to be stored, open both vent valves item 1 to remove pressure from meter and hoses. Drain fluid from meter and hose.
9. Go to next venturi station and repeat process.

***CAUTION:** Do not purge air from venturi system, as stated in steps 3 and 4, using water above +212°F. Water flashing to steam may cause severe harm to operator and damage to the equipment. To purge air from meter use special adapter shown on Figure 3. Run cold or domestic water through meter until air is removed from meter and hose. After closing meter valves, disconnect hose coupling from adapter and reconnect to venturi.

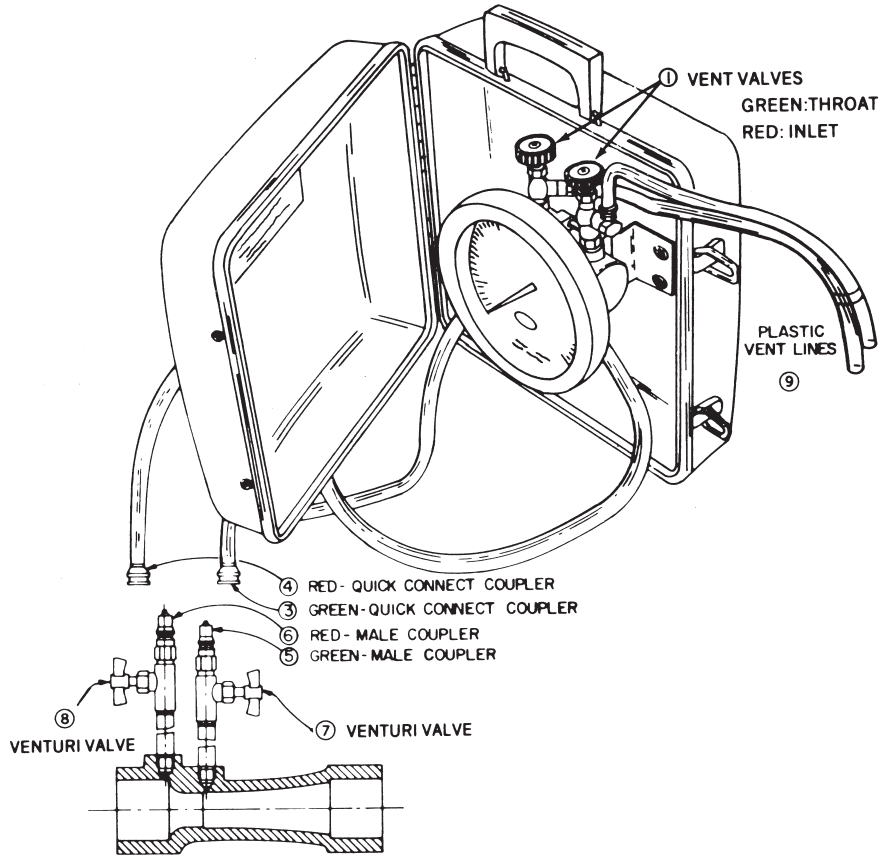


Figure 2. Portable differential pressure meter.

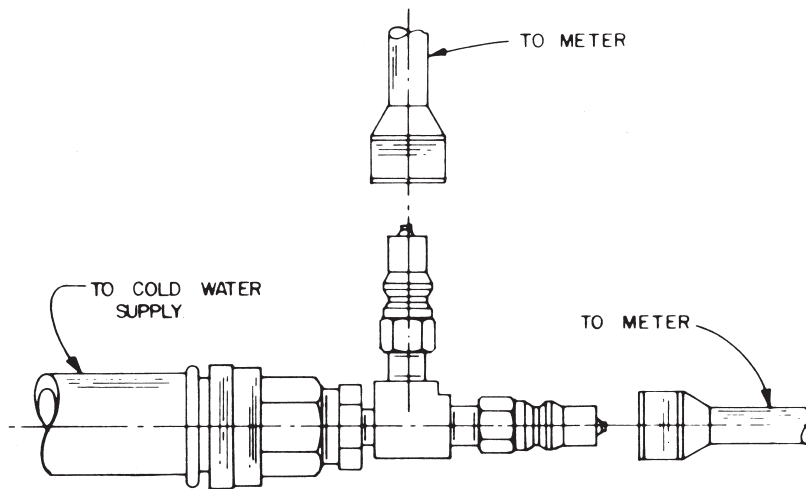


Figure 3. Purging adapter for purging meter in steam application.

III. Barco Fixed Meters (Wall and Panel Mounted)

Barco offers panel and wall mounted meters in single or multi-station configurations. Figure 4 shows the single station panel mounted meter; Figure 5 shows the multi-station panel mounted meter and; Figure 6 shows the wall mounted meter. These meters are offered as standard in a one (1) venturi station configuration. Additional stations are supplied upon request (multi-station shown as dotted lines in Figures 5 and 6).

The fixed meter (wall or panel) is supplied with the following items:

- Meter shut-off valves item 2.
- Bypass valve item 5.
- Vent valves, item 1.
- 6 inch dial differential meter.
- All pipe or tubing to connect the above items.
- Mounting bracket, item 6 (wall mounted meter only).

The fixed meters are not furnished with:

- The bleed vent lines
- The tubing connecting the venturi to the meter shut-off valves item 2.
- Panel (panel mounted meter)

1.0 Installation

1. Attach fixed meter to appropriate panel, mounting bracket or pad.
2. Using 1/4-inch copper connecting line (or equivalent), connect meter shut-off valves item 2 to venturi pressure tap. Connect red (inlet) meter shut-off valve to red venturi pressure tap and green (throat) meter shut-off valve to green venturi pressure tap.
3. Purge air from lines using water (line fluid).
4. Shut-off valves at the venturi are not necessary, but are recommended if meter system needs to be isolated. These

valves are supplied with the venturi as standard equipment.

2.0 Operating Procedure

Panel or wall mounted meters (refer to figure 4, 5 or 6).

1. Close all valves. Bleed vent valves item 1, meter shut-off valves item 2 and bypass valve item 5. (If used, venturi valves located at the venturi must be open during a reading.)
2. Purge air from inlet side of venturi meter system:
 - a) Open bypass valve item 5, meter red shut-off valve item 2 and red vent valve item 1.
 - b) Vent air until free water flows from the bleed vent line.
 - c) Close valves in the following order; red vent valve item 1, bypass valve item 5 and red shut-off valve item 2.
3. Purge air from throat side of venturi meter system:

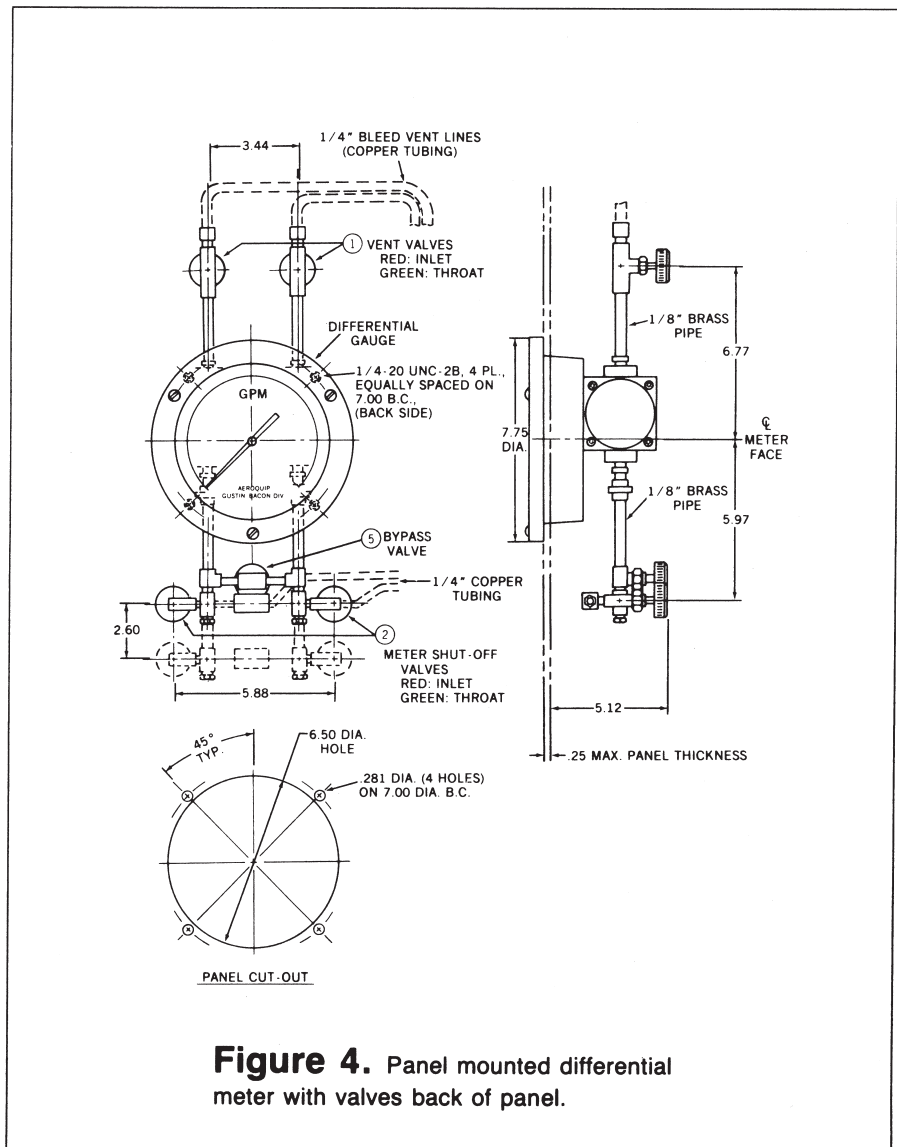


Figure 4. Panel mounted differential meter with valves back of panel.

- a) Open meter green shut-off valve item 2, green throat vent valve item 1 and bypass valve item 5.
 - b) Vent air until free water flows from the vent line.
 - c) Close valves in the following order; green vent valve item 1, bypass valve item 5 and green shut-off valve item 2.
4. "0" Check: Open bypass valve item 5. With shut-off valves item 2 closed, meter

should read "0" zero. If not "0" zero, repeat steps 2 and 3. Close bypass valve item 5.

5. Take flow reading: Open shut-off valves item 2 (bypass valve item 5 closed). If reading a ΔP meter (reads in inches of H_2O) go to step 7.
6. Refer to either the flow curve attached to the venturi, Section VII of this manual or Catalog 866B.

7. Where balancing is required, adjust balancing cock so that the proper reading (ΔP or GPM) is indicated on the meter.

8. Close meter shut-off valves item 2 and open bypass valve item 5. This will "0" zero the meter for the next reading.

If meter is not to be used for a period of time, open vent valves item 1 relieving pressure. Close vent valves item 1.

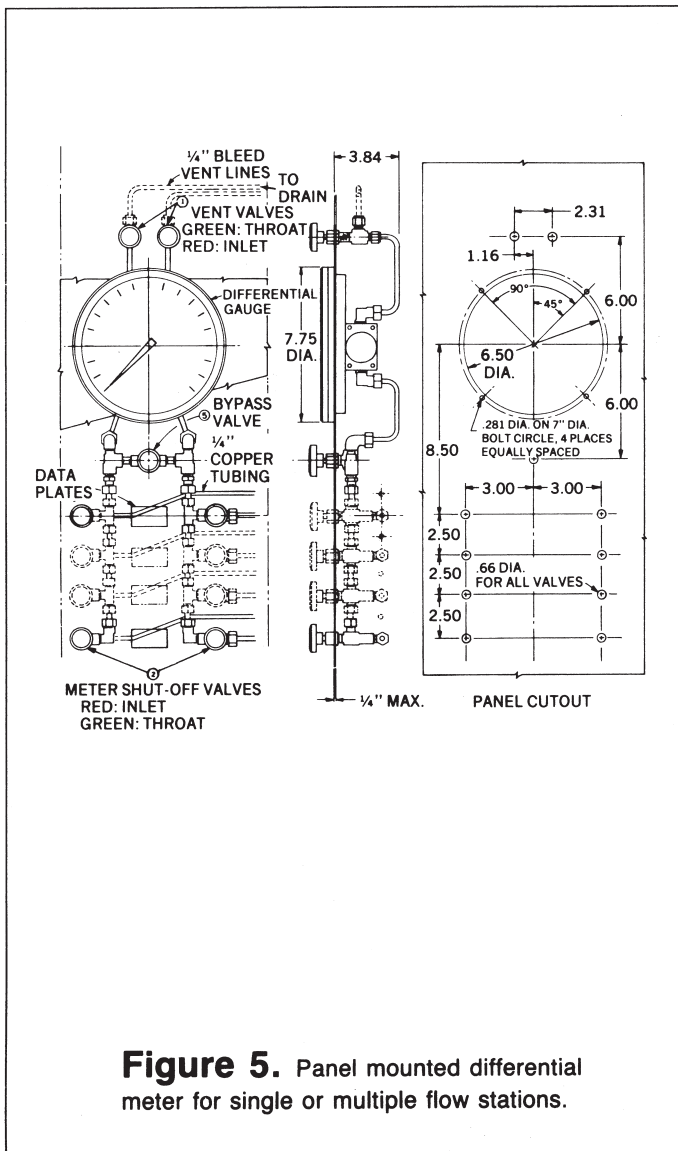


Figure 5. Panel mounted differential meter for single or multiple flow stations.

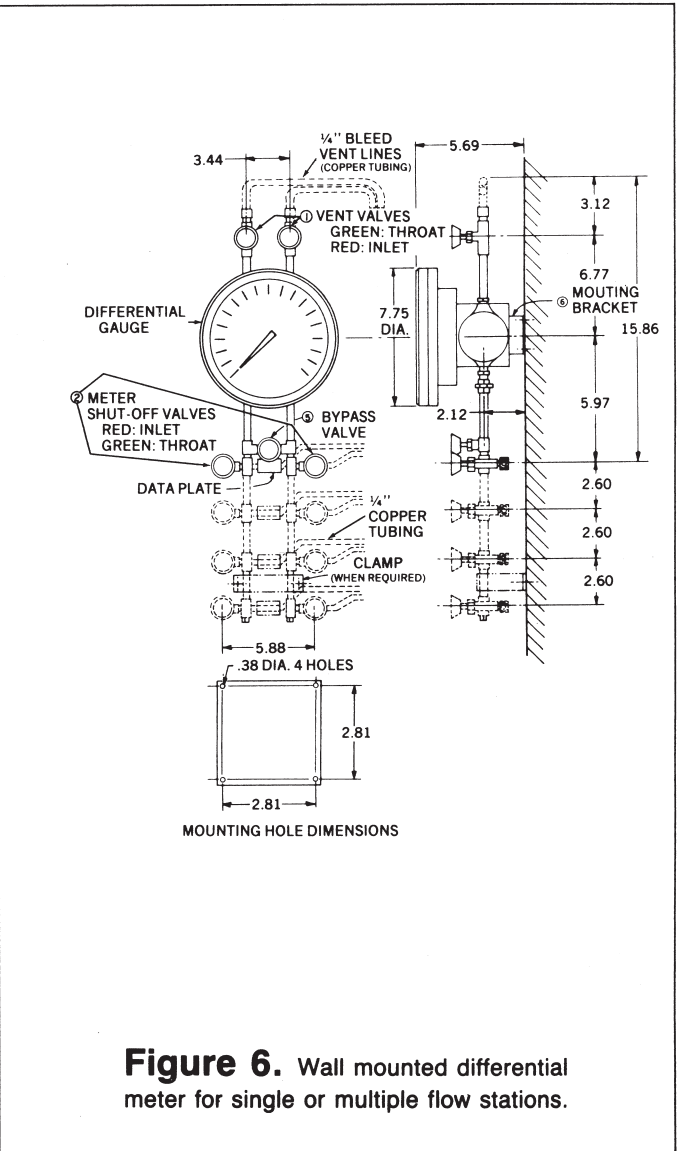


Figure 6. Wall mounted differential meter for single or multiple flow stations.

IV. High Pressure/High Temperature Applications

Table I.

Condition	Kit-Fitting	Meter
(a) + 250°F., 250 psi	Standard fitting kit supplied with venturi.	Standard portable or fixed meter.
(b) + 250°F., 500 psi	Standard fitting kit supplied with venturi.	Fixed Meter: Use Standard. Portable Meter: Special meter which includes stainless steel reinforced hose.
(c) + 400°F., 500 psi	Use special stainless steel fitting kit.	Fixed Meter: Special meter. Includes high temperature seals in meter and valves. Stainless steel socket valves are used. Portable Meter: Special meter. Same as fixed meter, plus special high temperature and pressure Teflon lined hose and 3/4 inch cold water adapter.

Consult your nearest Barco venturi representative or call the factory if more information is required.

1.0 Hot Water: Refer to Table I for the appropriate meter and fitting kit to be used on hot water systems.

2.0 Steam Service: It is recommended that seal pots, as shown in Figure 7 and 8, be used between the venturi taps and the meter. Two seal pots are required for each venturi, i.e., one for each venturi pressure tap.

Installation:

1. Connect venturi pressure taps to upper seal pot taps as shown on Figures 7 and 8 with 1/4-inch copper tubing (1/8-inch pipe).
2. For portable meter use, install the venturi quick disconnect coupling, valve and nipple to the lower seal pot tap.

- Red disconnect to be installed on tap.
- Green disconnect to be installed on throat tap.

3. Fixed meter—plumb directly between the lower seal pot tap and the meter. Refer to fixed meter installation, Section III of this manual.
4. Tubing connecting the venturi to the seal pot and from the seal pot to the fixed meter is not furnished with the seal pot. The mounting support and this tubing is to be supplied by the contractor.
5. For air purging of system and for taking a flow reading, refer to Section II and III of this manual.
Caution: When purging, the seal pot is not to be emptied of water or condensate.

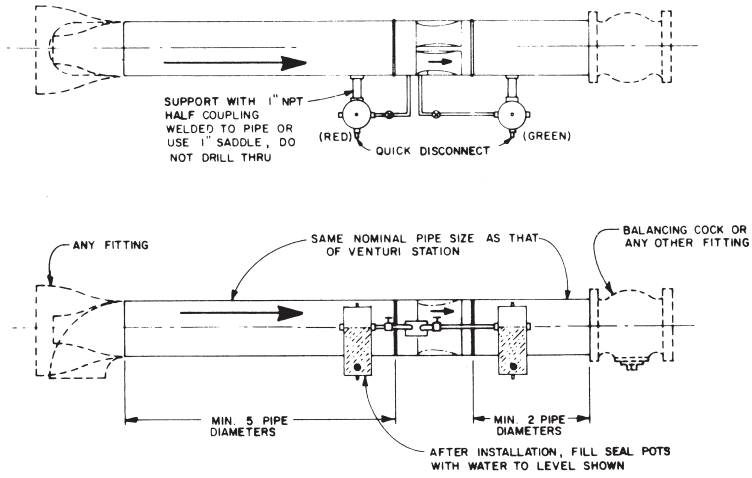


Figure 7. Horizontal installation for Barco venturi using seal pots for steam service.

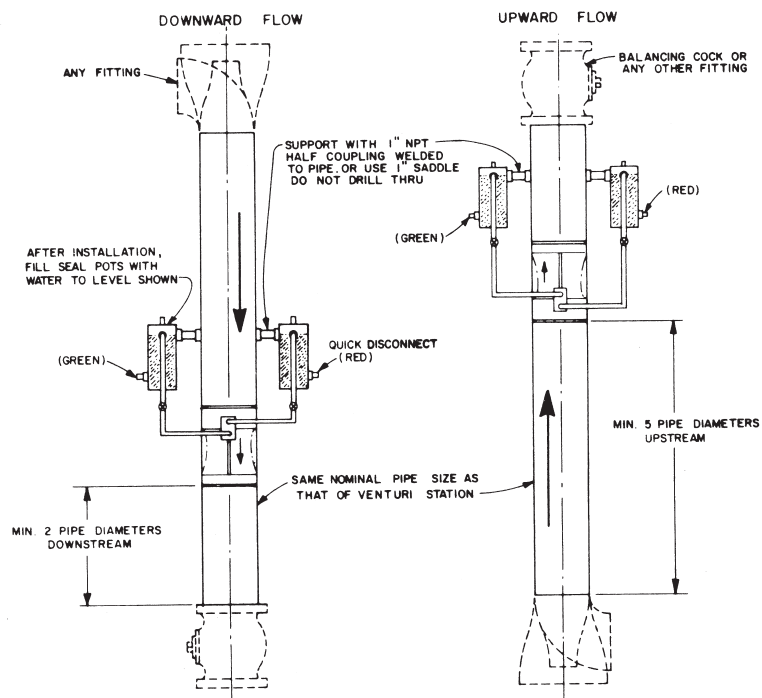


Figure 8. Vertical installation for Barco venturi using seal pots for steam service.

V. Venturi Monitoring Equipment

1. Hydraulic to Hydraulic:

The hydraulic to hydraulic system uses the pressure differential between inlet and throat areas of the venturi to activate a differential pressure meter. The indicated readings are usually in:

- a) inches of water which can be converted to GPM via a conversion flow chart.
- b) direct reading in GPM, or,
- c) % of total flow.

All of the following devices use the hydraulic pressure differential to activate the readout device.

A. Direct Reading Meters:

Pressure differential meters that can be used with the Barco venturi.

- a) *† The ITT/Barton differential pressure meter (available through Barco) Model 226-6" dial, $\pm 1/2\%$ full scale accuracy.
- b) *† Meriam meter—Model 1126-6" dial, $\pm 1/2\%$ full scale accuracy.
- c) * Midwest—Model 110,6" dial $+ 1/2\%$ full scale accuracy.
- d) * Midwest—Model 130 (Delta Meter) $\pm 2\%$ accuracy full scale. By calibration a $\pm 1\%$ at a given point.
- e) * Mercury or Water Manometer. Manometers are usually laboratory or fixed station devices and can be extremely accurate.
- f) * Digital read out devices—Ashcraft Digigauge differential pressure readout.

B. Recording Meters:

Two basic units can be used with the venturi. These are:

- 1) A flow recorder, that accurately records the pressure differential of the venturi. This differential can be converted to GPM via the calibration curves. Direct reading GPM scales are also available.
- 2) Integrating (totalizing) flow recorders are also available that will use the venturi pressure differential and maintain a reading on the total flow in the pipe line.

Both recording devices are relatively expensive and can be obtained from the following companies as well as others: (See below for addresses.)

- a) * ITT/Barton—Model 202A Flow Recorder or Model 243B/252B Integrating Flow Recorder
- b) * Foxboro—Model 40 Flow Recorder

C. Pressure transducers can be used with the Barco venturi.

- a) * Rosemount
- b) * ITT/Barton

2. Hydraulic to Electronic Readout Systems

An electronic readout system can also be used to measure fluid flow. This system uses the hydraulic differential pressure created by the venturi to actuate the transmitter or transducer (an electrical mechanical device) and send an electronic signal to the readout device.

There are several manufacturers of each component as well as suppliers of the total electronic package. Barco's preferred unit is the Foxboro 843 d/p cell transmitter. This can be supplied with a 3 valve manifold and mounting bracket. This unit will provide a 4 to 20 mA dc signal and has .25% accuracy.

Other suppliers:

* Validyne Engineering Co.,
19414 Londerious Street
Northridge, CA 91324

* Rosemount, Inc.
P.O. Box 35129
Minneapolis, MN 55435

* ITT/Barton
580 Monterey Pass Road
Monterey Park, CA 91754

***NOTE:** Wide variations in readout devices, types of transducers, amplifiers, etc., make it impractical for Barco to supply the electronic package. The manufacturers listed are for reference only. By listing these companies, Barco does not recommend any particular product, nor vouch for their accuracy, reliability or dependability. Contact with suppliers on this equipment will enable the user to pick components that will meet his needs and application.

† Meters normally supplied by Barco Corporation.

VI. FM Venturi Installation

Refer to NFPA No. 20 for installation and testing of firepump stations. Appendix A, Figure A-2-10.2.1 (C) and A-2-10.2.1 (D) of NFPA 20, shows schematically the arrangements that may be used in applying flow measurement devices to the firepump station. Figure 9 and 10 are pictorial references of these schematics.

For a portable meter application, refer to Section II of this manual for installation and operational instructions.

For fixed meter applications, refer to Section III of this manual for installation and operational instructions.

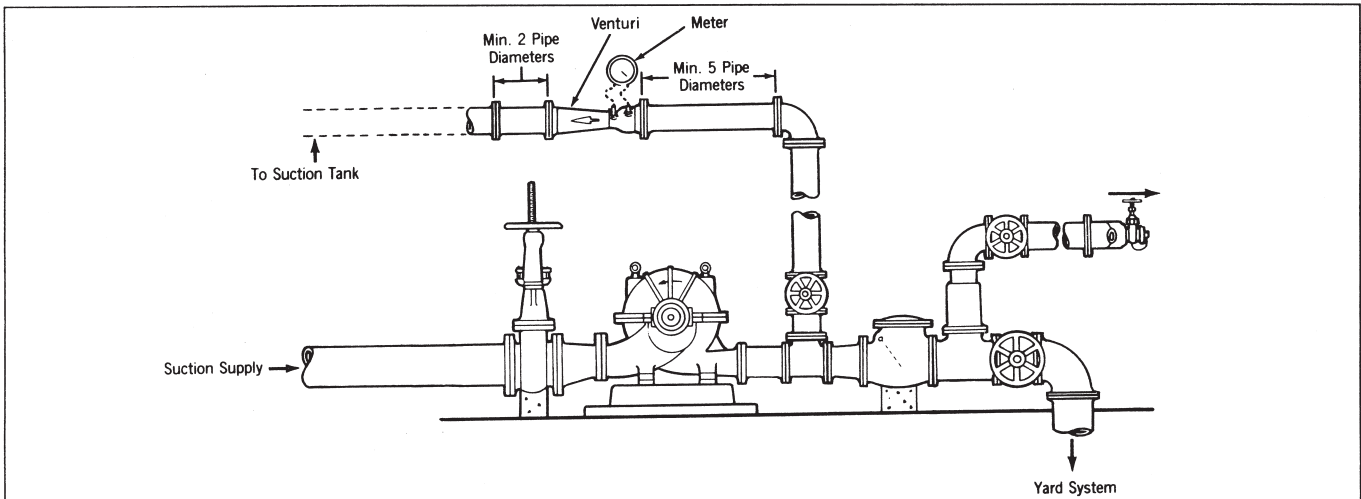


Figure 9. Typical FM venturi application from suction tank supply.

NOTE: A valve may be needed between the venturi and suction tank to make certain a back pressure is created in the venturi. In some cases, when the line between the venturi and suction tank is short and there are no restrictions, the venturi reading may fluctuate. This is caused by not having enough back pressure in the venturi.

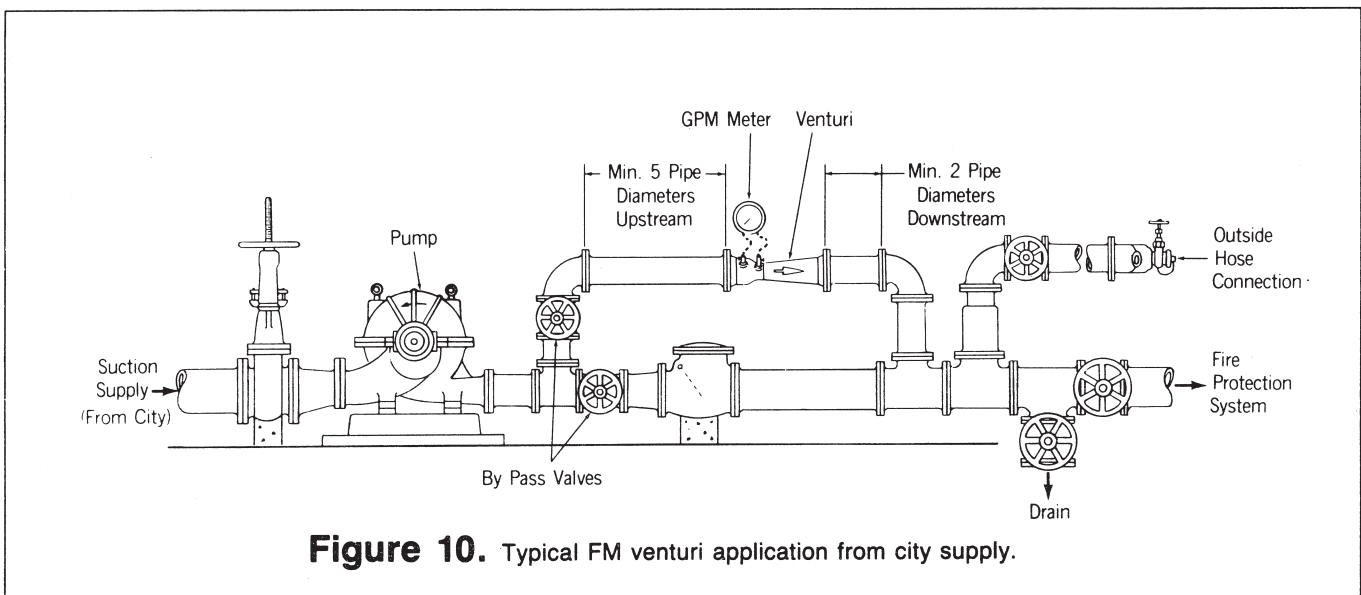


Figure 10. Typical FM venturi application from city supply.

VII. Capacity Curves

How to Use

The following pages provide all the information necessary to select and specify the venturis for your system. First, establish your line size and determine the flow requirements. Then refer to the sizing curve which covers the line size. Flows into gallons per minute are scaled along the bottom of the chart. The meter reading from 3 inches to 300 inches of water, is scaled along the left side of the chart. Since the graph is scaled on logarithmic lines, the curve appears as a straight line.

Select a venturi with a beta ratio that will produce a reading between 20% and 100% of the meter. For example, if we wish to flow 20 GPM of water through a 1¼-inch pipe, we turn to the 1¼-inch curve on page 16 and select the #588 venturi, which gives us a differential pressure of 28 inches of water. Select a 0 inch to 50 inch meter with readings occurring between 10 inches and 50 inches H₂O. The #588 refers to the beta ratio or the relationship of the venturi throat I.D. to the pipe I.D.

Example:

